Hydro

Latest Revision : October 19 2015 - Revision 5238

October 19, 2015 - Revisions 5233 - 5238

Included neighbourhood techniques for time-series output (Section 4.31.5 User's Manual).

August 20, 2015 - Revisions 5188 - 5199

Include spatial decorrelation length scale diagnostic (Section 4.30.17 User's Manual).

August 11, 2015 - Revisions 5171 - 5175

Added tracer filling and filtering options (Section 4.9.8 User's Manual).

August 6, 2015 - Revisions 5148 - 5163

Added merged fluxes option for FFSL (Section 9.4 User's Manual).

Added STOKES to ramp (Section 4.3 User's Manual).

Added Stokes momentum tendencies (Section 4.30.10 User's Manual).

Added MacCready river mouth salinity approximation (Section 4.10.6 User's Manual).

Added Stokes vortex force (Section 4.20 User's Manual).

Added mean temperature and salinity (Section 4.30.2 User's Manual).

June 4, 2015 - Revisions 5113 - 5123

ROBUST flags re-configured for RECOM.
Include EXCLUDE_BGCSED for process exclusion (Section 4.4 User's Manual).

April 10, 2015 - Revisions 5096 - 5102

Added NOGRAD option for FFSL (Section 9.4 User's Manual).

Recast roammode flags (Section 7 User's Manual).

April 10, 2015 - Revisions 5063 - 5084

No overwrite of timeseries file using -g option.
Totals for 2D tracers is the areal mean (Section 4.30.16 User's Manual).
Allow clamped nesting standard OBC; NEST_CPD (Section 4.10.27 User's Manual).
Allow false pole to be specified for grids using DX and DY (Section 4.6.4 User's Manual).
Added river salinity tracer (Section 4.10.6 User's Manual).
Included river length for salt balance (Section 4.10.6 User's Manual).
Set monotonicity constraint for FFSL cross terms.
Refinement of mempack file generation.

December 12, 2014 - Revisions 5008 - 5016

Added vector attributes to tracers for simple output.

Bugfixes to salt balance in OP_NOSALT OBC options.

Bugfixes on Stokes velocity implementation.

November 13, 2014 - Revisions 4964 - 4985

Added TRATIO < 1 for FFSL (Section 4.11 User's Manual).

Added age tracer (Section 4.30.5 User's Manual).

Added expanded CFL diagnostic (Section 4.30.9 User's Manual).

Allow sourcesinks to be specified using region files (Section 4.23 User's Manual).

Added unit tracer (Section 4.30.13 User's Manual).

Added spatially variable tracer decay rate (Section 4.9 User's Manual).

Added regions to compute partcle age within (Section 4.28.3 User's Manual).

Region residence times computed using mean flow (Section 4.30.17 User's Manual).

Reset OBC CLAMPD default to tracer fill value.

Added light to default timeseries output.

TRCONF scaled for inflow only.

September 16, 2014 - Revisions 4905 - 4917

Added option to override pss volume fluxes for ffsl.
Added scaling factors for point sourcesinks (Section 4.22 User's Manual).
Reformulated density scaling OBC (Section 4.10.18 User's Manual).
Reformulated density scaling initial conditions (Section 4.9 User's Manual).
Added regional initial conditions (Section 4.9 User's Manual).
Bugfixes for regions (non-transport mode).

August 27, 2014 - Revisions 4880 - 4883

Added multiple blocks for bathy modification (Section 4.8 User's Manual).
Added 'default' for window sizes (Section 4.2 User's Manual).
Added tracer initialisation using inverse density profile (Section 4.9 User's Manual).

August 8, 2014 - Revisions 4850 - 4854

Bugfixes for pointsourcesinks with flow in transport mode using FFSL.

August 6, 2014 - Revisions 4828 - 4844

Added depth based relaxation for sea level (Section 4.11.1 User's Manual).

Added TRCONF boundary condition (Section 4.10.17 User's Manual).

Added UPSTRM open boundary condition for FFSL.

Added conservation options for FFSL.

June 20, 2014 - Revisions 4793- 4811

Allow forcing of conservation for eta or w in transport (Section 9 User's Manual).
Include Stokes drift velocity (Section 4.19 User's Manual).
Include cosine/exponential depth relaxation (Section 4.9.2 User's Manual).
Bugfixes to FFSL.

June 20, 2014 - Revisions 4768 - 4782

Bugfixes on dumps/read for non cell centered variables.
Bugfixes to FFSL.
Allow OBCs to overwrite velocity if specified.
Allow transport fill (MONOTONIC|NONE) to operate with PSS_INPUT=IMPLICIT.

June 10, 2014 - Revisions 4751 - 4757

Bugfixes to adaptive relaxation.
Added relaxation time constant tracer for adaptive relaxation.

June 10, 2014 - Revisions 4729 - 4734

Added file input for surface and bottom DESCAL & dens_scale options (Sections 4.9 & 4.10.18 User's Manual).
Added depth dependent tracer relaxation ((Section 4.9.2 User's Manual).

June 5, 2014 - Revisions 4718 - 4727

Included density scaled initial condition for tracers (Section 4.9 User's Manual).
Included density scaled OBCs for tracers (Section 4.10.18 User's Manual).

May 15, 2014 - Revisions 4701 - 4715

Included isotropic mixing in sponges (Section 4.10.15 User's Manual).
Added averaging for tracers & w for CORNER_MEANS.
Hard relaxation for velocity using CORNER_MEANS.
Transport file dumps with FFSL: only dump waterss if npss > 0.
Read in eta_t for GLOBAL mode in transport model.
Include 2D mean velocity in transport mode.

May 15, 2014 - Revisions 4670 - 4693

Included additional wave enhanced mixing methods (Section 4.19 User's Manual).

Reset defaults for dynamic river method (Section 4.10.6 User's Manual).

Included option to average across OBC overlap (Section 4.10.7 User's Manual).

Included river input salinity diagnostic for TRCONC.

Apr 8,9 2014 - Revisions 4628 - 4646

Added block reads for BATHY_MASK. Included NLAND (set blocks to land) (Section 4.8, User's Manual).
Added ROBUST = 0 option (optimized). Improved ramping of geostrophically initialised velocities on boundaries (Section 7, User's Manual).
Allowed for rivers with multiple cells. Streamlined dynamic riverflow options.
Changed ROAMv 5, ROBUST 4 to hard relaxation over spinup (Section 7 User's Manual).
Added temporal linear relaxation for tracers/eta (Section 4.9.2, 4.11.1 User's Manual).

Mar 5, 2013 - Revisions 4553 - 4564

Included residence time in regions (Section 4.29.16 User's Manual).
Included point source/sink input on at multiple horizontal locations (Section 4.23 User's Manual).

Feb 18, 2013 - Revisions 4516 - 4537

Included scale_factor for exposure maps output units (Section 13 User's Manual).

Include boundary bathymetry smoothing (Section 4.10.24 User's Manual).

Reference dynamic river input pycnocline depth to the free surface (Section 4.10.6 User's Manual).

Included porus plate code (experimental).

Include bathymetry RESET using -p mode (experimental).

Dec 16, 2013 - Revisions 4498 - 4507

Included bathymetry statistics (Section 4.8 User's Manual).
Added Smagorinsky to transport mode

Nov 25, 2013 - Revisions 4460 - 4484

Include DYNAMIC river input method (Section 4.10.6 User's Manual)
Added Smagorinsky smoothing parameter (Section 4.21 User's Manual)
Added restart options for particles (Section 4.27 User's Manual)
Added open boundary OPTIONS (Section 4.10.6 User's Manual)
Write setup.txt to output directory (Section 4.31 User's Manual)
Print computational sequence in DEBUG_LOC (Section 4.31 User's Manual)
Added a modified ROAM auto parameterisation (roammode=5)
Added ROMS grid generation (Section 4.4 User's Manual)
Added RECOM (roammode=6).

May 17, 2013 - Revisions 4347 - 4375

Added reference depth for sourcesinks (Section 4.22 User's Manual).
Allow standard files to dump modulo formats (Section 4.20.6 User's Manual).
Added extended types to tracers (Section 4.9.7 User's Manual).

Added tracer exposure and rmse tracerstat (Section 13 User's Manual).

April 12, 2013 - Revisions 4308 - 4320

Included auto mode for RECOM, Use -rg option with ROAMv = 5.

April 3, 2013 - Revisions 4282 - 4301

Added mean volume flux (Section 4.29.2 User's Manual).

Included Flux Form Semi-Lagrange (FFSL) write/read option in transport mode.

Allow auto tracer attributes to be re-read by tracer name.

Bugfix on auto tracer indexing.

Bugfix on crash recovery for multiple windows.

March 20 2013, Revisions 4261 - 4282

Added GLOBAL transport mode (Section 9 User's Manual)

Added dual flux adjustment time-scales (Section 4.10.7 User's Manual).

Added Flather radiation standard conditions (Section 4.10.27 User's Manual).

Added geostrophic velocity initial condition (Section 4.11 User's Manual).

Prevent window transitions occurring along OBC boundaries.

October 8, 2012 - Revision 4167 - 4181

Added sediment and BGC automation framework.

Tracer scaling can be handled via tracer tag attribute (Section 4.9.5 User's Manual).

Added general tracer surface flux specification (Section 4.9.6 User's Manual).

September 20, 2012 - Revision 4166

Fixed Ecology seg. fault in previous revision

September 10, 2012 - Revision 4155-4165

Included ecology autotracers.

Included OBCs in sediment and ecology autotracers.

August 31, 2012 - Revision 4138-4150

Included sediment transport automation (Section 15 User's Manual).

August 21, 2012 - Revision 4127-4137

Added automatically generated sediment tracers.

August 16, 2012 - Revision 4115-4127

Allowed a transport output DT to be specified for TRANS_FILES (Section 9 User's Manual).
Allow all variable initialisation (2D, 3D, sed) using TRACER_DATA (Section 4.9.1 User's Manual).
Streamlined tracer initialisation; added 2D and sediment tracer initialisation at runtime.
Allow sediment layers to be read from parameter file if not specified in input file.

August 7, 2012 - Revision 4111

Added ability to output netcdf dumps in DAILY, MONTHLY or YEARLY chunks (Section 4.30.6 User's Manual).

Included auto sediment tracer attributes.

Included library error handling for sediments.

July 23, 2012 - Revision 4035 - 4083

Run regulation for time-series, point source-sinks (Section 4.31.1 User's Manual).
Added tracer tendencies (Section 4.29.10 User's Manual).
Allow multiplicative boundary scaling (Section 4.10.25 User's Manual).
Added netCDF file initialisation for new tracers (Section 4.9.1 User's Manual).
Added parameter file revision number.
Added library error handling.
Added means, debugging, auto transport file output to transport model.

May 7, 2012 - Revision 3991 - 4024

Included window partitioning methods (Section 4.2 User's Manual).

Included run regulation (Section 4.31.1 User's Manual).

Included more standard OBCs (Section 4.10.27 User's Manual).

Included multi-dumpfiles (Section 4.30.7 User's Manual).

Bugfix for density with layerfaces > 0.

Allow open boundaries in the domain interior (i.e. doesn't need to be adjacent to OUTSIDE cells).

April 13, 2012 - Revision 3985 - 3991

Various bugfixes for TRCONC.

April 11, 2012 - Revision 3980 - 3985

Added RIVER boundary specification (Section 4.10.6 User's Manual).

Allow multi files for data using NEST1WAY & RIVER boundary specification.

Bugfix for dew-point multifiles.

April 5, 2012 - Revision 3963 -3975

Added compatible V1957 - this creates makes without the open boundary ghost cells. Use with pre-V1957 window map files.

Added mean runtime ratio to diag.txt.

Bugfixes for sediment/ecology process exclusion and OBC ghost initialisation.

March 27, 2012 - Revision 3963. Note: svn repository has moved to https://svnserv.csiro.au/svn/EMS/src/main

This has resulted in the leap in version numbers.

Added TRCONC and TRFLUX boundary conditions (Section 4.10.6 User's Manual).

Added standard NEST1WAY boundary condition (Section 4.10.7 User's Manual).

Added 2-way nesting capability.

February 14, 2012 - Revision 1958

Changes to calculation of shortwave radiation in heatflux.c:

1. Maximum irradiance (se) calculated using a cosine function instead of piecewise linear interpolation in time.

2. Alternative cloud cover algorithms added, but Reid (1977) is still used.

3. dtime function modified to account for time zone.

Latest Revision : Dec 18, 2011 - Revision 1957

December 18, 2011 - Revision 1935-1957

Included crash recovery (Section 6.4 User's Manual).

Included exclusion of cells for sediments, BGC, waves and tracerstats (Section 4.4 User's Manual).

November 28, 2011 - Revision 1913-1932

Added mean offset (Section 4.30.2 User's Manual).

Added standard deviation for regions (Section 4.30.15 User's Manual).

Added default timescale for local flux adjustment (Section 4.10.7 User's Manual).

Added raw data dump when computing tracer scaling. Added multifiles for scaling data (Section 4.9.4 User's Manual).

Made meteorological variables (airtemp, wetbulb, cloud, precip) multi-files

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September 21, 2011 - Revision 1855-1902
Included a bottom stress diagnostic (Section 4.30.11 User's Manual).

Included option to explicitly set bottom drag (Section 4.19 User's Manual).

Bugfixes for inter-tidal wetting and drying.

Bugfixes for alert diagnostics on multiple windows.

Bugfix for mean region mass on multiple windows.

Bugfix for tangential radiation stress transfers on multiple windows.

Improved transport fill algoritms.

June 7th, 2011 - Revision 1828-1848
Numerous bugfixes to regional budgets (Section 4.30.15 User's Manual).

Added volume error to transport output using semi-Lagrange (Section 9 User's Manual).

Added additional level of transport checking, TR_CHECK (Section 9 User's Manual).

May 13th, 2011 - Revision 1799-1828

Added mass budgets for regions(Section 4.30.15 User's Manual).

Added semi-Lagrange advection scheme for momentum (Section 4.11 User's Manual).

Added percentile sub-sampling of input file (Section 10 User's Manual).

Addressed numerous bugs identified by Mark Szyszka (MetOcean Engineers).

Mar 25th, 2011 - Revision 1748-1788

Added velocity relaxation (Section 4.12.1 User's Manual).

Added adaptive relaxation (Section 4.12.1 User's Manual).

Added tidal removal method for eta relaxation (Section 4.12.1 User's Manual).

Added open boundary data path (Section 4.10.3 User's Manual).

Added more debugging functionality (Section 4.32 User's Manual).

Added memory packet IO in library functions.

Mar 3rd, 2011 - Revision 1748 (FR)

Added OpenMP support. "openmp" is now an option for DP_MODE. This yields somewhat better performance than pthreads and will make it easier to parallelise other code, plus it is more robust and offers more flexibility than pthreads. It also paves the way for MPI support coming soon. We will soon have the ability to run SHOC in hybrid MPI/OpenMP mode. This will now run the '-g' option in parallel as well.

To use run configure with the '-enable-omp' option and then specify 'openmp' for the DP_MODE parameter.

Feb 2nd, 2011 - Revision 1724-1745

Added maximum momentum tendencies diagnostic (Section 4.30.9 User's Manual).

Added memory packet output (not documented yet).

Added OutputPath to TRANS_OUTPUT files.

Added time increment input for FILEIN OBC input.

Added check for Nan on tracer input & replace with nearest non-NaN.

Bugfixes for velocity initialisation using multiple windows.

Bugfix for GEOGRAPHIC_RECTANGULAR false-pole grid specification.

Fixes for ROAM with improved OBC flux adhuxtment algorithm.

Feb 2nd, 2011 - Revision 1705-1724

Added automated transport output file dumps(Section 9, User's Manual)

Changed OBC flux adjustment to read eta using FILEIN rather than eta_relaxation. The previous input method can be invoked using COMPATIBLE = V1670 (Section 4.10.7, User's Manual)

Bugfix on anisotropic grid refinement.

Jan 21st, 2011 - Revision 1670-1705

Allow prescribed tracer to set the density (Section 4.4, User's Manual)

WRITE_BDRY invoked on -p and -g modes (Section 4.10.25, User's Manual)

Kinetic energy added to NUMBERS (Section 4.30.11, User's Manual)

Allow reinitialisation or no initialisation for CONSERVE in transport mode (Section 9, User's Manual)

Write a transport file in -g or -p mode (Section 9, User's Manual).

Grid refinement allows different factors in x and y directions and grid refinments reverts a PRECONDITIONED refined grid to a uniform grid (Section 4.29, User's Manual). Isotropic grid refinement maps used with COMPATIBLE = V1652.

Grid blending added (Section 4.29, User's Manual).

Allow river input over multiple cells (e.g. the sum of inputs = total flow).

Modified DEBUG info to include 3D velocity and u1inter / u2inter values.

Included data assimilation scheduling.

Dec 13th, 2010 - Revision 1669-1670 : FR

- Added multi ts-file support for point source/sinks. Multiple timeseries files can now be listed in the prm file and they are considered as if everything was in the one file
- Added new 'use_eqn' custom boundary condition. This calls the new equation parser routines in the EMS library and allow boundary conditions to be a combination of tracers (Section 4.10.8 User's Manual).
- Modified LIGHT to be read from a tracer instead of file

August 20, 2010 - Revisions 1641-1652

Added quadratic, cubic and quartic interpolation for the semi-Lagrange advection scheme (Section 9 User's Manual).

Added code to stop streamline intrusions into land for the semi-Lagrange scheme.

Bugfix to total mechanical energy diagnostic using ALERTS.

Bugfix to sediment-ghost cell maps (only affects semi-Lagrange scheme).

July 27, 2010 - Revisions 1612-1632

Transport mode; added local fill and implicit pss input.

Use 4th order approximations and detadt from the 3D mode in vel_w_bounds() (Section 4.11 User's Manual).

Zero velocity used above the surface for horizontal momentum advection and no-gradient for vertical advection (Section 4.11 User's Manual).

Added V1598; no-gradient on velocity above the surface for momentum advection. Low order approximations and detadt from the 2D mode in vel_w_bounds() (Section 4.4 User's Manual).

Added 2nd order upwind advection scheme for tracers (stable for Courant < 2) (Section 4.11 User's Manual).

Added NUMBERS: SLOPE, SURF_LAYER & DUMMIES (Section 4.31.15 User's Manual).

Added FILTERING option. Only 1st order Shapiro filtering of momentum tendencies is currently supported (Section 4.11, 4.4 User's Manual).

Moved momentum advection code from momentum/vel3d.c to momentum/advect.c.

Bugfix for sediment TOTALS.

June 10, 2010 - Revisions 1584-1598

Added mechanical energy diagnostic (Section 4.31.11, User's Manual).

Added wet cell diagnostic (Section 4.31.11, User's Manual).

Source terms for short wave radiation penetration added implicitly in vertical diffusion.

Bugfix on ETAMAX specification.

Bugfix on monotonic global filling for the transport mode.

May 28, 2010 - Revisions 1562-1581

Made short wave radiation attenuation, transmission and bottom absorption 2D auto-tracers.

Short wave contribution to the water column included as a source term in vertical diffusion.

Added FLUX_ADJUST (for OBCs) as a RAMP variable. By default it is turned off.

DEBUG_LOC can be invoked using the auto (-a) mode.

April 21, 2010 - Revisions 1539-1562

Bugfixes for MONTHLY, SEASONAL means.

Included a timeseries type (Section 4.32.5, User's Manual).

Included a RIVER specification for -a and -g modes (Section 5, User's Manual).

Allow albedo to be computed from hour angle and cloud amount if -1<albedo<0 (Section 4.18, User's Manual).

April 13, 2010 - Revisions 1525-1538

Added MONTHLY, SEASONAL and YEARLY dump intervals (Section 4.32.6, User's Manual).

Added MONTHLY and SEASONAL increments for MEANS (Section 4.31.1, User's Manual).

Made all MEANS into rolling means.

April 7, 2010 - Revisions 1498-1523

Added temporal percentile computations (-ps mode) (Section 10, User's Manual).

Reworked particle settling and added swimming/mortality (Section 4.29, User's Manual).

Added Sigma_t in NUMBERS (Section 4.31.11, User's Manual).

Allowed window maps to be created using the -p mode Section 4.2, User's Manual).

Added scaling to the eta relaxation data in OBC local flux adjustments, and changed the relaxation ramp (Section 4.11.7, User's Manual).

Added particle concentration as an auto-tracer.

A no-gradient condition above the surface is set for tracers after the sed/eco step if sediments or ecology is invoked.

April 7, 2010 - Revisions 1487-1498

Added sonic depth variable.

Bugfixes to global filling algorithm.

Improved the mapping function for multi-grid transport.

March 18, 2010 - Revisions 1417-1487

Added code to set up INEXACT multi-grids for transport (Section 9.1, User's Manual)

Added T/S NaN fatality checks (Section 4.4, User's Manual).

Added instability de-bugging diagnostics (Section 4.33, User's Manual).

Added ability to dump boundary location information (Section 4.11.25, User's Manual).

Check for eta NaNs on input and replace with nearest non-NaN. Remove wet 'holes' on input.

Read in 2D TRANS_VARS in transport mode (e.g. wave variables).

AVHRR accepts the file list as input.

ETA_RELAX included in default RAMPVARS.

Chenged coordinate attribute for vertical velocity to z_centre so that coordinates can be inferred on input.

Bugfixes for ROAM multiple windows.

Bugfix for read/write of window maps.

Bugfix to check for lost particles vertically.

Included additional checks for valid thin layers.

February 1, 2010 - Revisions 1412-1417 (FR)

Added capability to specify plain ascii files for tracer.data field. Must have at least lon, lat and tracer value but may contain other columns for convenience. New `iterp_type` field, this can be '`linear`' (default), '`cubic`', '`nn_sibson`' or '`nn_non_sibson`'. Any grid points that are outside the interpolation field of influence are padded with the `fill_value`. Note: there is no 3D support at the moment all wc and sed layers are indentically distributed horizontally.

Also fixed the bug that was causing the 2D and sediment variable's `.data` and `.data_sed`, respectively, field not to be honoured

December 7, 2009 - Revision 1398 - 1399 (FR)

Added timing for transport mode.

December 7, 2009 - Revision 1395 - 1397 (FR)

Added option to log timing statistics. use the "`--enable-do-timing`" configure option and then build as per usual. Model runs using this version of SHOC will log timings for various stages in the file timing.txt

December 2, 2009 - Revision 1385 - 1394

Added a more efficient method to set thin layers for multiple windows.

November 27, 2009 - Revision 1349 - 1371

Bugfix for multiple windows: Smagorinsky, k-ε, k-ω and MY2.5.

Added additional attributes to particle output file.

November 19, 2009 - Revision 1343 - 1349

Bugfix: set h1au1 and h2au2 where undefined for Smagorinsky calculation.

November 18, 2009 - Revision 1337 - 1343

Changed attribute organisation in particle output file.

Bugfixes on thin layer merging masks.

November 17, 2009 - Revision 1331 - 1337

Added more attributes in particle tracking output file.

Added more checks for multifile wave and pressure forcing.

November 17, 2009 - Revision 1331 - 1337

Added more attributes in particle tracking output file.

Added more checks for multifile wave and pressure forcing.

November 16, 2009 - Revision 1283 - 1331

Added HEATFLUX_RAMP (Section 4.18 Users' Manual).

Added WATER_TYPE for shortwave penetration (Section 4.18 Users' Manual).

Added eta scaling for open boundaries (additive only), Section 4.11.24 Users' Manual.

Sonic depth / sound channed added to SOUND diagnostic (Section 4.31.11 Users' Manual).

Multifile input available for wave variables and atmospheric pressure.

ADVANCED heatflux renamed to BULK. Backwards compatibility is maintained.

Bugfix on transport mode. Added heatflux ramp and explicit mappings to transport mode.

Bugfix for Schumann-Gerz stability function.

Numerous bugfixes for multiple windows. **IMPORTANT** these fixes render multiple windows non-backwards compatible. The changes are:

1. Grid metrics (e.g. botzgrid) are now correctly set at ghost cells.

2. Cell thickness at cell faces (dzu1 and dzu2) are transferred correctly. These are used in tracer horizontal diffusion.

3. Surface boundary condition for vertical velocity (wtop) is set correctly at window boundaries.

4. Vertical gradients of velocity in MY2.0 and k-e are set correctly by looping over cell centres. Some auxiliary cells were not captured when looping over cell faces with multiple windows.

5. cells to process vectors include open boundary cells based on global, rather than window, open boundary structures.

6. Thin layer adjustment occurrs over all cells used from other windows, not just E,W,N or S directional cells (i.e. diagonals are included).

IMPORTANT: Several general bugs have also been identified and corrected:

1. A surface u2 velocity was used in the u1 bottom stress, used in vertical diffusion. This has been changed to the bottom u2 velocity (note this is included in a sum of 4 velocities; the remaining 3 were correctly specified).

2. Wet cells with land to the west & east or north & south are now correctly contained in the cells to process vector. These locations are required to compute the horizontal viscosity.

3. Ghost cells at the backward time-step are correctly set using the lateral boundary conditions. These are not set correctly in the Asselin time filtering since velocities at the forward timestep are not computed in ghost cells. This affects the stress tensors for horizontal viscosity.

4. Newly wetted cells are set before the lateral boundary conditions are computed, so these locations are correctly set at land-water boundaries.

5. Backward velocites subjected to thin-layer merging are restored to original values in the vertical diffusion scheme. If the bottom lies in the layer below the surface, the u1 backward velocities are used in u2 vertical diffusion to

compute the bottom stress, and the un-merged velocities are required to be used here.

IMPORTANT these changes render the code non-backwards compatible for 1 or multiple windows. Backward compatiblity for points (2) and (3) above can be established for one window (even though solutions are subject to the above bugs) by setting the flag:

COMPATIBLE V1283

September 11, 2009 - Revision 1256 - 1283

Included SP_CHECK to check sparse files generated for the transport mode (Section 9 Users' Manual).

Added vertical mixing to the transport mode.

Added new boundary conditions for tracers, TRCONC & TRFLUX (Section 4.11.16 Users' Manual).

Added open boundary condition on vertical velocity, BCOND_W.

Changed global cells to process vector to exclude e1/e2 open boundary cells.

Added COMPATIBLE flag to invoke backwards compatibility. Currently:

- V1246 will include e1/e2 open boundary cells in global cells to process vector.
- V794 will use VISC_METHOD=PRE_V794 for horizontal viscosity.

Improved performance of streamline origin computation in the transport mode for thin layers.

Bugfix on MONOTONIC global filling for the transport mode.

Bugfix on WIMPLICIT - **IMPORTANT** previously horizontal advective tendencies were zero.

Bugfix on v1256 bugfix for mean velocities.

August 13, 2009 - Revision 1256

Bugfix for Mean velocities. This is really an artifact of fixing the model time to keep in sync of the 3d timesteps.

Also added support for dumping out the stack trace on a segmentation fault

July 13, 2009 - Revision 1228 - 1246

Added near real-time operation mode, -nrt (Section 6, User's Manual).

Added run identifier tag (Section 4.4, User's Manual).

June 30, 2009 - Revision 1208 - 1222

Added implicit vertical advection (Section 4.12 Users' Manual, Section 5.1.8 Science Manual).

Added read/write of window map to netCDF file (Section 4.2 User's Manual).

Added bathymetry smoothing of selected cells (Section 4.9 User's Manual).

May 13, 2009 - Revision 1148 - 1190

Improved global filling algorithm for the transport mode. Volume error diagnostics and time series of residual mass and scaling factors now available.

SWR_BOT_ABSORB may be input via netCDF file as a 2D spatially varying field (Section 4.18 User's Manual).

A scaling factor, SPONGE_FACT, is included for NSPONGE_HORZ (Section 4.11.14 Users' Manual).

Wave enhanced vertical mixing improved for k-e and k-w schemes (Section 4.22.10 User' Manual, 6.10 Science Manual).

Choice of stability functions for turbulence closure (Section 4.22.9 User' Manual, 6.10 Science Manual).

Wilcox 1988 closure scheme added (Section 4.22.8 User' Manual, 6.9 Science Manual).

OUTSIDE_ZONE added to fill OUTSIDE cells adjacent to open boundaries (4.11).

Streamlined tracer relaxation for -a option (Section 4.10.1 Users Manual).

INVERSE_BAROMETER is switched off if no PRESSUE file is supplied.

Bugfix for Orlanski radiation when relaxed to data (backward time-step used rather than current time-step). **IMPORTANT**: this will be non-backwards compatibe when BCOND_ETA = FILEIN|ORLANS or FILEIN|CAMOBR.

Bugfix for eta landfills.

Bugfix in fcw() function for k-w.

February 11, 2009 - Revision 1076 - 1130

Improved MONOTONIC global filling for the transport mode.

Added conservation option for non-Lagrange transport mode (Section 9 User's Manual).

Added option to ignore leap years for the transport mode (e.g. when using MOM4 input) (Section 9 User's Manual).

Added momentum sources for sourcesinks (Section 4.24 User's Manual).

Added option to horizontally smooth Vz and Kz with Shuman filter (Section 4.22.3 User's Manual).

Added heatflux components from MOM4 input (Section 4.18 User's Manual).

Added time step and boundary volume fluxes for TOTALS (Section 4.31.14 User's Manual).

Shortened INVERSE_BAROMETER tag (Section 4.11.15 User's Manual).

Added OutputPath for alerts, totals and flushing.

Changed interpolation at NaN cells to cascade searches for MOM4 conversions.

Changed loop for wave routines to be over wet points only.

Bugfix to include OBC cells for multiple windows using bcond_ele = NOTHIN.

Bugfix for cascade searches.

December 15, 2008 - Revision 1036 - 1075

Modified transport model to allow different source and target grids.

Added STREAMLINE option for transport model (i.e. streamline origin saved and read from file).

Added source/sinks for momentum (Section 4.24 User's Manual).

Added current speed squared diagnostic (Section 4.31.11 User's Manual).

Added run number sequence diagnostic (Section 4.4 User's Manual).

Added OutputPath to set path for netCDF and timeseries output (Section 4.32.6 User's Manual).

Various bugfixes: sourcesink for multiple windows, CUSTOM velocity BCOND_TAN forcing, cyclic offsets for MOM conversions, zoneshift for TIDALC.

August 14, 2008 - Revision 1006 - 1025

Included explicit maps in bathymetry smoothing.

Allow a name and path for restart files.

Local OBC solutions added and available for use with FLATHR (Section 4.11.5 User's Manual).

Bugfix for TIDALC to allow for local timezones (i.e. TIDALC constituents must be relative to the local timezone).

Bugfixes for Smagorinsky mixing with sponges, u1 PRESS_BC tendency, T/S relaxation and OBC energy flux diagnostic.

July 11, 2008 - Revision 1000 - 1002

Bugfixes to tracerstats.

July 9, 2008 - Revision 979 - 999

Temperature and salinity relaxation now performed every timestep (rather than input_dt).

Temperature, salinity and elevation relaxation time constant can be read from file (with temporal and spatial variation).

May 20, 2008 - Revision 968 - 975

Bugfix for VELOCITY initialisation.

Bugfix for re-setting maps in tracers/reset_map_t(). **IMPORTANT :** This may alter vertical velocity and vertical advective u1 and u2 fluxes across eastern and northern open boundaries respectively, hence affect backwards compatibility.

May 16, 2008 - Revision 966 - 967

Bugfix for OBC stagger in ROAM configuration.

May 15, 2008 - Revision 955 - 964

Added tracer missing value and missing_value_sed to be maintained in model UR

Missing value landfill function available (fill_rule missing_value).

Speed of sound routines now in lib/math/underwater.c. Default SOUND calculation is unesco_speed_of_sound().

May 13, 2008 - Revision 947 - 955

Added OFAM velocity as auto tracers (ovelu, ovelv).

ROAM defaults changed (ROAMv4, SPEED 5, ROBUST 6). Inverse_barometer and VELOCITY initialisation on.

May 08, 2008 - Revision 922 - 944

Tracer checks for NaNs give a warning only.

Bugfixes and inprovements to inner stagger OBCs.

Bugfixes to OBC flux adjustment. Added tide (e.g. bcond_ele NOTHIN|TIDALH) and inverse barometer effects to flux adjustment.

Bugfixes to uv_to_u1av, uv_to_u2av, hdstd_to_u1 and hdstd_to_u2 OBC custom routines.

Created separate module (inputs/readparam_r.c) for ROAM configuration.

Added VELOCITY initialisation from a 3D horizontal velocity field (e.g. VELOCITY velocity_file.nc).

Added a ramp period for OBC inverse barometer effect (e.g. RAMPVARS INV_BARO).

Added eta relaxation during the ramp period (e.g. RAMPVARS ETA_RELAX).

Added velocity data input for roam (e.g. VELOCITY_DATA velocity_file.nc).

Added local OBC velocity approximations (e.g. bcond_nor LOCALN, bcond_tan LOCALT).

Added hdstd_to_u1av and hdstd_to_u2av custom OBC routines.

Added phase speed smoothing to FLATHR (e.g. bcond_ele FLATHR|FILEIN|ORLANS, SMOOTH_PHASE 0.7).

Apr 08, 2008 - Revision 888 - 918

Added ability for outside or inside open boundary staggers (Section 4.11.2 User's Manual).

Fixed bugs on FLATHR passive radiation using inside staggers. Modified active FLATHR to use linear local solution (Section 4.11.5 User's Manual).

Added ability to change a zone of wet cells to OUTSIDE cells adjacent to an open boundary (Section 4.11 User's Manual).

Added checks for NaNs on tracer initial conditions.

Modified ROBUST = 6 for ROAM (constant VH, Smagorinsky KH).

Added cyclic compatibility for MOM gridspec conversions. Added the ability to create shorter input files for use with extremely large grids (usage = shoc -g in.prm in_short.nc).

Oct 26, 2007 - Revision 848 - 851

Fixed running without wave library UR

Oct 26, 2007 - Revision 821 - 841

Added improved filling method for the transport mode to ensure a monotonic solution (Section 4.21 User's Manual). This method is the default.

Added fill method options for the transport mode (Section 4.21 User's Manual).

Added OBC phase speed diagnostic for elevation (Section 4.31.11 User's Manual).

Added temporal phase speed smoothing for elevation (Section 4.11.9 User's Manual).

Added increments for velocity for data assimilation. This functionality is currently commented out.

Bugfix for Kondo Bulk fluxes using MESOLAPS met data.

Oct 10, 2007 - Revision 807 - 819

Added UPSTRM OBC for use with LAGRANGE (e.g. in transport mode).

Bugfix for source-sinks (source-sink input depth range now correctly tracks sea level variations).

Buxfix for WINDOWS > 1 & HEATFLUX ADVANCED (density is transferred to the master).

Horizontal diffusion operational for transport model (as long as stability is satisfied).

Added wave enhanced vertical mixing; WAVES VERT_MIX (Section 4.21 User's Manual).

Included Craig and Banner (1994) wave enhanced vertical mixing for k-e (Section 4.22.6 User's Manual).

Oct 2, 2007 - Revision 797 - 803

The pre-version 794 formulation of horizontal momentum mixing has been retained (see entry below for an explanation of differences). This is invoked using:

VISC_METHOD PRE_V794

Sep 27, 2007 - Revision 738 - 794

Included wave library; Section 4.21 User's Manual.

IMPORTANT : wave routines now reside in /model/lib/waves/

Added additional tracers for TOTALS (Section 4.31.14 User's Manual)

Added OBC eta relaxation zone (Section 4.11.8 User's Manual)

Added OBC 2D velocity forcing, 2D point array output and OBC flux adjustment on velocity forcing (Section 4.11.6 User's Manual)

Added state variable increments for data assimilation (Section 4.10.3 User's Manual)

Added wind drag diagnostic in NUMBERS (Section 4.31.11 User's Manual)

Added Kondo (1975) bulk wind drag (Section 4.14 User's Manual)

Added wave enhanced vertical mixing, after Craig & Banner (1994)

Moved all horizontal momentum mixing to separate module and made invoke mixing via function pointers. Bugfixes on stress tensors.

IMPORTANT : The stress tensors for the horizontal momentum formulation has been altered and is no longer backwards compatible.

Blumberg and Herring (1987) multiply the first term in t11 (t22) by h2 (h1). This seems to be in error, as for uniform h1 & h2 the units of the mixing term don't equate to ms-2. Also Apel (1987) derives the mixing tensors in Cartesian coordinates and multiplies the first term in the t11 (t12) stress tensor by 2, rather than h2 (h1). This latter formulation is now considered correct, and modifications to the code have been made to reflect this. The corrected formulation may need tuning of U1VH and U2VH to attain stability, i.e. current code may not be backwards compatible with older parameter files. To revert to the pre v794 formulation for backward compatibility reasons, set;

VISC_METHOD PRE_V794

Improvements to MOM conversions (OBC's inside domains, OBC list in grid_spec.nc, scaling in df_mom.c)

July 9, 2007 - 726 Revision 723

Fixed error when number of output files exceeds limit, increased number of output files limit to 300. UR

July 3, 2007 - Revision 723

RANGE specification for OBC lists (Section 4.11, User's Manual)

SMOOTH_VARS and SCALE_VARS specification (Section 4.4, User's Manual)

Allow dewpoint input for ADVANCED heatflux (Section 4.18, User's Manual). Heatflux now works with MESOLAPS products.

SPEED_2D and SPEED_3D included in NUMBERS (Section 4.31.11, User's Manual)

Wave interactions cleaned up. Radiation stresses included (Section 4.21, User's Manual).

IMPORTANT : WAVE_ENHANCED_BOTTOM_FRICTION is superseded by WAVES and is no longer functional.

Dumpfiles in sigma mode are mapped to the vertical layers specified in the parameter file.

Time series master-slave transfers included and optimised master filling for output dumps.

Wanings for TINY violations disabled. TINY now set to 1e-20.

June 28, 2007 - Revision 685

fixed memory bug in preprocessor UR

May 2, 2007 - Revision 642 - 673

Included scaling options for horizontal diffusion; see Section 4.22 User's Manual.

Added a variety of fill_rules; Section 4.31.6 User's Manual. Atmospheric variables (wind, pressure) are also filled.

Added ability to explicitly change SURFACE (e.g. for tsunami modelling); Section 4.13 User's Manual.

IMPORTANT : Feedback of waves to hydro is formally included by setting WAVE_ENHANCED_BOTTOM_FRICTION YES. The default (or if absent) is NO. Note that an ORBITAL_VEL file must be present to invoke wave friction. Bottom roughness is modified in the sediment code if ORBITAL_VEL is

present regardless of the status of
WAVE_ENHANCED_BOTTOM_FRICTION. See Section 4.20 User's Manual.

OBC's for tracers may be set using tracer names, e.g.
BOUNDARY0.BCOND_temp; see Section 4.11 User's Manual.

A warning is issued if variables become less than TINY=1e-100 if linked to ecology.

All heatflux components are included in output using COMP_HEAT.

Mar 6, 2007 - Revision 630 - 641

Included layer thickness diagnostic for sigma (SHOW_LAYERS = YES). Minor bigfixes for sigma.

Included FILEIN|NOTHIN OBC. NOTHIN is relaxed to FILEIN on the RELAX_TIME scale.

Included zero_fill and no_fill fill rules for output.

Feb 22, 2007 - Revision 628 - 629

Changed the MEAN_DT default for ROAM to account for negative START_TIME

Feb 13, 2007 - Revision 621 - 627

Bug fixes on sigma layer computation and particle tracking cleanup.

Feb 09, 2007 - Revision 600 - 620

Added AVHRR heatflux to relax temp surface to AVHRR sst data.

Added custom tide specification where tidal amplitude and phase constituents are read from file (Section 4.11.15 user's Manual).

Modified Smagorinsky smoothing using ROBUST parameter (diffusion is smoothed ROBUST-1 times and has an upper limit of -U1KH, -U1VH etc.).

Jan 18, 2007 - Revision 583-593

Added land maps for dump cascade fills to speed up land filling.

Added post-processing on AVHRR images to remove land/cloud contaminated pixels and smooth image.

Bugfix on global filling in transport mode.

Jan 8, 2007 - Revision 580

Added Executable name to setup log UR.

Nov 22, 2006 - Revision 565-567

Enabled wildcards for variable definitions under the file identifier, i.e. 'file#.vars Phy*' will include all variables starting with Phy.
Enabled provision of external files instead of providing data in parameter file for: file#.points -> file#.pointfile, BATHY -> BAHYFILE, X& YCOORDS -> COORDFILE, NTRACERS - TRACERFILE, TSPOINTS -> TSFILE, npointss -> pointssfile. Note that the old/original identifier will always overwrite the file directive UR.

Nov 17, 2006 - Revision 558

Added relaxation times for ingoing and outgoing OBC radiation conditions.

Added 'NONE' mode for transport model (i.e. run transport with no advection: IO only).

Included MOM4 gridspec generation and file output in MOM4 format.

Nov 9, 2006 - Revision 530

Increased the number of allowable tracers to 300

Sep 18, 2006 - Revision 523

Added the ability to read in extra tracers for the transport mode (see Section 8 User's Manual).

Sep 2006 - Revision 512

restart facility and .cf file format introduced by Jason Waring

Aug 11, 2006 - Revision 504

Optimized LAGRANGE scheme for transport and added global tracer fill to conserve mass during advection.

July 31, 2006 - Revision 491

Tracer percentile diagnostic included - see Section 4.30.12 of User's Manual.
Tracer fluxes have been changed to text based tracer name specification in the input file rather than the tracer number (Section 4.30.1 User's Manual).
Flushing tracer is changed to a boolean input with an auto tracer 'flush' generated for FLUSHING_TR YES (Section 4.30.4 User's Manual).

IMPORTANT : The boolean FLUSHING_TR and CALC_FLUXES fields are no longer backwards compatible and .prm files must be changed to:

CALC_FLUXES NONE

FLUSHING_TR NO

Sparse formatted output files can have the 'modulo' attribute (Section 4.31.6 User's Manual). Transport mode now accepts input files with modulo specified.

July 27, 2006 - Revision 472

Bugfixes on transport mode.

July 25, 2006 - Revision 470

Previously caused disruptions on 64 bit machines running multiple partitions in threaded mode have lead to make the asynchronious dumping of output optional. The flag to be set to enable is 'SCHED_MODE pthread', if the entry is missing or different threading will not be used for the dumping of output. UR

July 21, 2006 - Revision 467

Transport mode is now functional : refer to 'Transport mode' (Chapter 8) in the Users Manual. Sparse format files can be generated as output. Refer to Section 4.31.6 in the Users Manual. These files are accepted as input into PLUM. Sparse format files are accepted as input for tracer resets.